FOREST PEST MANAGEMENT
Pacific Southwest Region

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AN EVALUATION OF INSECT, DISEASE, AND HAZARDOUS TREE CONDITIONS AROUND SILVER LAKE, AMADOR DISTRICT, ELDORADO NATIONAL FOREST

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ABSTRACT

Two campgrounds and a summer home tract in the Silver Lake recreation area were examined for insect and disease conditions that might affect the forest vegetation. Insects and diseases present included red fir dwarf mistletoe, annosus root disease, Jeffrey pine beetle, mountain pine beetle, and the fir engraver. General management alternatives to deal with these pests are presented.

Discussion of the hazardous tree situation in the recreation area is also included. Additional information on recognizing hazardous trees and developing a hazardous tree management program is enclosed. Types of defects that have the highest probability of causing failure are discussed.

INTRODUCTION

At the request of Glenn Gottschall, District Ranger, Amador District, Gregg DeNitto and John Wenz of the Forest Pest Management Staff met on September 15, 1981 with Bernie James and Roger Dinslage of the Amador District and examined the Silver Lake and Silver Lake West campgrounds. On September 16, 1981 DeNitto and Wenz met with Ranger Gottschall and inspected the summer cabin-special use permit area along the east side of Silver Lake. The objectives of the evaluation were 1) to diagnose the primary pest-related problems and provide information for use in developing long-term vegetation management plans, including insect and disease considerations, for the developed campground areas and 2) to provide on-the-ground aid to District personnel with respect to identifying, evaluating, and managing hazardous tree situations.

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OBSERVATIONS/DIAGNOSIS

The areas evaluated were in the red fir vegetation type. The two campgrounds also had components of Jeffrey and lodgepole pine, while the summer home tract was almost completely red fir with some lodgepole pine along the lake shore. The stands consisted primarily of an old-growth overstory with varying densities of regeneration in the understory.

Trees with the potential for failure were noted throughout the area, especially in the vicinity of the summer cabins. In addition to the insects and diseases discussed below, factors observed contributing to the hazardous tree situations included the advanced age of many of the trees and the presence of wounds, particularly basal wounds. A higher proportion of the observed wounds occurred on trees adjacent to the narrow roads, driveways and parking areas than occurred on trees away from these situations.

Many of the insects and diseases commonly associated with old-growth red fir stands were observed. The insects included the fir engraver (Scolytus ventralis) in red fir, Jeffrey pine beetle (Dendroctonus jeffreyi) in Jeffrey pine, and mountain pine beetle (D. ponderosae) in lodgepole pine (see Appendix for insect and disease biologies). The Jeffrey pine beetle has recently been attacking old, scattered individual trees, while the mountain pine beetle was found in lodgepole pine growing in areas subject to a fluctuating water table. The fir engraver was associated with both branch and top-killing, as well as scattered tree mortality. Pine engraver (Ips spp.) activity was not noted at this time, but the beetles are present in the area and should be considered a potential problem.

Annosus root disease (Fomes annosus) was identified in some windthrown firs and in fir stumps throughout the areas. Red firs in the developed campgrounds were infected with dwarf mistletoe (Arceuthobium abietinum f.sp. magnificae), but it was not observed in the summer home tract. Cytospora canker (Cytospora abietis) had infected red fir branches that supported dwarf mistletoe infections. This canker fungus was killing some of these branches resulting in branch flagging.

PROGNOSIS

Current mortality appears to be at levels that can reasonably be expected under "normal" conditions. Unusually high levels of mortality and/or top kill, such as occurred during and for a short time after the 1975-1977 drought, were not observed. However, a combination of the advanced age of the overstory, the existence of overstocked aggregations, the pest complexes, and high recreational use, in the absence of mitigating management actions, can be expected to result in increased tree mortality and incidence of hazardous trees.

HAZARDOUS TREE EVALUATION

Considerable research on hazardous trees and their management is available and several relevant publications are enclosed. It is not the intent of this report to reiterate the information in these publications, but, instead, to highlight certain points and provide information specific to Silver Lake. Most of September 16 was spent on-site with Ranger Gottschall discussing hazardous tree identification and management.

The Silver Lake area is populated principally by large, old-growth red fir. This species has several characteristics that make it susceptible to failure. One of the more important is the high susceptibility of the wood to decay. This can result in the breaking out of dead tops, bole breakage at old, open dwarf mistletoe cankers or from heartrot, the entry of root and butt rot fungi into basal wounds and fire scars, and windthrow. Basal wounds are one of the principal entry points for decay organisms and the volume of decay behind them can be estimated for true firs. The amount varies with the age and size of the wound, but on the average, the gross merchantable board foot volume comsumed by decay organisms increases about 1 percent each year. During the first decade after wounding there is little noticeable decay, but this changes with the passage of time. In addition to structural weakening by decay, basal wounds can cause other hazards. Because of their location, these wounds are prime receptors for root rot fungi (principally Fomes annosus) which, once established, can seriously affect the structural integrity of the support roots and can subsequently spread through the roots underground to infect the roots of adjacent healthy trees. A third problem with basal wounds is the interaction with decay. The wound can weaken the tree cylinder and create an out-of-round effect from any callus ridges. This, in conjunction with bole decay, can result in a synergistic action increasing the probability of failure.

In addition to butt and bole decay, red firs are attacked by the fir engraver which can cause mortality, top kill, or patch kill of the cambium. F. annosus and dwarf mistletoe may increase the susceptibility of firs to bark beetle attacks. Dead tops in fir are susceptible to decay at their base which can result in their breaking out, especially during windy weather.

Therefore, four factors, root rot, basal wounds and butt rot, bole decay behind old dwarf mistletoe cankers, and top breakage create the highest probability of failure of red firs. The pines, in general, are less susceptible to failure. Bole decay associated with deep, horizontal cankers, expecially when more than 16 feet above the ground, is a significant factor, as are large forks with acute angles, in the production of hazardous pines.

A risk-free recreation area is not attainable without drastically altering the site; however, a hazardous tree management program, ranging from taking preventive action, primarily through vegetation management, to tree removal, can reduce the risk to acceptable levels. Hazard management levels need to be established that will provide an acceptable safety standard and that can be implemented with available resources.

Hazard tree management in recreation areas is a continuous process that is best accomplished within the context of a vegetation management plan through the use of a set procedure that includes maintaining written records. Many procedures have been developed for this purpose, but one of the more complete with a substantial data base is that of Dr. Lee Paine (see enclosed publications). This system attempts to quantify, based on historical records, the probability of tree failure and the resultant economic loss if failure occurs. If the rating exceeds the hazard control level, a decision can then be made as to what control action to take. This can include tree removal, removal or relocation of the target, or mechanically reinforcing the tree. The specific action taken will depend on the value of the tree and its importance to the site. The District might consider as one alternative adoption of this or a similar system. It would have the benefit of providing a documented quantitative basis for decision-making in hazardous tree management, as opposed to "professional judgement". Implementation and continued operation of the system would require a commitment of dollars and personnel.

PEST MANAGEMENT ALTERNATIVES

Two basic pest management alternatives are appropriate for consideration in the Silver Lake recreation area: 1) a continuation of current management direction (hazard tree removal) and 2) implementation of specific pest management strategies. The latter provides opportunities for preventing and reducing pest-related damage.

1. No Change in Current Management Direction. Hazardous trees will continue to be removed as they occur and are identified. No actions are taken to reduce the incidence of hazard trees or reduce/prevent potential pest-related damage/impacts. The presence of predisposing factors (root disease, dwarf mistletoe, overstocked aggregates), will contribute to continued, and probably increased, bark beetle associated top kill and tree mortality. The overstory pines will be most susceptible during periods of drought, especially if surrounded by a dense fir understory. Windthrow of root-rotted red firs will continue, possibly injuring recreationists or damaging physical improvements and surrounding vegetation. New annosus root disease centers will be established when green and recently killed conifers are removed. Dwarf mistletoe will continue to spread and intensify in the red fir with the understory becoming heavily infected and the overstory having continued branch flagging from Cytospora infection.

2. Pest Management. Several specific pest management options are available to prevent and/or reduce pest related damage and impact.

a) Annosus root disease. The creation of additional annosus root disease centers can be reduced by the application of borax (sodium tetraborate decahydrate) to freshly cut conifer stumps (see FSM 2331.33 R-5 Suppl.). Submission of a Pesticide-Use Proposal (FS-2100-2) is required.

Management of existing annosus root disease centers requires species conversions to reduce the impact of this disease and to provide a safe, vegetated cover. Where F. annosus infects pine species, regenerating and favoring non-coniferous species is necessary. Any conifer is susceptible to infection through underground contact with the pine root system. If only true firs are infected, then non-coniferous species and/or pines could be grown in the center. Thinning the firs around root disease centers may stimulate root regeneration to minimize the effects of the loss of roots and maintain green vegetation; however, in the long run, this may result in the creation of hazardous trees if the primary support roots decay.

b) Dwarf mistletoe. In general, actions that increase the vigor of the stand will alleviate some of the dwarf mistletoe and bark beetle (see below) related problems. This can best be accomplished by a thinning of the overstory and understory with careful selection of the residual trees. Retention of a dwarf mistletoe-infected red fir understory is possible if it is released and can maintain adequate height growth (about one foot per year). However, if it continues to be infected from above by residual overstory it will not be able to outgrow the dwarf mistletoe. Favoring the pine species, and even planting pine in some situations, will also be beneficial by disrupting the canopy continuity and developing a greater species mix.

c) Bark beetles. Two appropriate bark beetle management alternatives exist: 1) mitigation of predisposing conditions or factors and 2) individual tree protection. Bark beetle problems are often associated with trees/stands that have been weakened or stressed by some predisposing agent or condition. Important predisposing factors noted in the Silver Lake area included annosus root disease, dwarf mistletoe, overstocking and mechanical injury to trees near campsites and along roads. From the standpoint of preventing pine engraver problems, proper slash management practices, particularly in the spring and early summer, are critical. The management alternatives discussed above relative to F. annosus and dwarf mistletoe coupled with regulation of stocking levels and species composition on an aggregation by aggregation basis should reduce bark beetle related damage. Vegetation management that results in healthy, vigorous stands should also reduce the impacts of non-manageable factors like drought. Sometimes, the methods for eliminating or reducing predisposing conditions, such as thinning, may be incompatible with other management objectives and/or political realities. At the same time, long-term bark beetle related losses cannot be significantly reduced without alleviating the predisposing factors.

Individual tree protection might be considered in situations where high value trees are under severe temporary stress (thus predisposing them to bark beetle attack) from a factor(s) or condition(s) that will diminish in

a relatively short time and from which the trees can reasonably be expected to recover. An example would be trees scorched, but not killed, by fire. Under such conditions, treating the bole of the high value trees during the "susceptible" period with an insecticide to prevent successful bark beetle attack may be warranted. Currently, Sevimol 4 carbaryl insecticide is registered as a preventive treatment for pines against the mountain and western pine beetles.

CONCLUSIONS

In the long run, a vegetation management plan for the Silver Lake recreation area that takes into account insect, disease and other pest considerations, offers the best opportunity for managing pests. Silviculturists, recreation management specialists and landscape architects, as well as entomologists and pathologists, should ideally be involved throughout the planning process and the formulation of specific management prescriptions.

The Forest Pest Management Staff is available for further input into the management of the Silver Lake recreation area. This includes providing more detailed information that would assist in the development of a vegetation management plan and training in the recognition of hazardous trees.

APPENDIX

Insect and Disease Biologies

Annosus root disease. Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species are rarely damaged or killed. In some instances madrone (Arbutus menziesii) and a few brush species, including manzanita (Arctostaphylos spp.) and sagebrush (Artemisia tridentata), are attacked. Infected pines are usually killed rather rapidly when the fungus girdles the root collar. Older true firs and incense-cedars usually survive infection for many years, although butt and root rot may become extensive resulting in tree weakening and windthrow.

During favorable periods, the fungus forms fruiting bodies in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from air-borne spores produced by the conks, and then grows into the root system. True fir can also be infected by spores invading live roots and fresh basal wounds. The fungus subsequently spreads to healthy roots of surrounding susceptible tree species via root contacts. In general, infections will cross from pine to true firs; however, rarely is the fungus observed to go from true fir to pine. Local spread of the fungus outward from a stump typically results in the formation of disease centers, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of nonsusceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Dwarf mistletoe. Dwarf mistletoes are parsitic seed plants that require living host tissue to survive. Each species has a limited host range that is usually confined to one or two commercial conifer species.

Dwarf mistletoes are major causes of growth loss and reduced vigor and can be mortality factors, especially in a complex with bark beetles and drought. They can also form large witches brooms in tree crowns, especially pines, and large bole cankers, principally in true firs.

Mature seeds are usually produced in late summer and fall and are forcibly ejected from the fruit. They are covered by a sticky, gelatinous coating and adhere on contact. The seeds germinate in the spring and infect twigs

less than two years old near the needle base. In two to three years shoots appear and these produce fruit in another two to three years. The infection in the branch can survive as long as the host tissue is alive.

Spread of dwarf mistletoe is relatively slow. Individual seeds are usually shot horizontally 15 to 20 feet, although infections high in crowns may send seeds over 100 feet when assisted by wind. However, horizontal spread in an even-aged pine stand averages one to two feet per year with a vertical spread rate up the crown about four inches per year. In true fir stands, the average horizontal spread rate is similar, but the vertical spread is somewhat less at three inches annually.

Jeffrey pine beetle. Dendroctonous jeffreyi attacks only Jeffrey pine and has one generation per year. The adults usually fly and attack green trees during the summer and early fall, June-October. Successfully attacked trees often do not fade until the spring or early summer following attack. The Jeffrey pine beetle does not breed in slash and normally attacks scattered, slow-growing individual trees or small, 2-3 tree groups that have been predisposed by factors such as root diseases, heavy dwarf mistletoe infection, lightning, drought, and overstocking or old age. High-level activity is characterized by mortality occuring in large groups of up to 20 to 30 trees of varying ages. Under such conditions, trees can be successfully attacked regardless of vigor as the healthy tree may be overcome by large numbers of attacking beetles. In the Silver Lake area, the mountain pine beetle, D. ponderosae, has a similar one-year life cycle except that it attacks lodgepole pine. Lodgepole pine influenced by a fluctuating water table, such as near the lake shore, ponds, intermittent streams, or run-off courses, are particularly susceptible to attack, especially if in overstocked aggregations.

Fir engraver. Scolytus ventralis attacks most western true firs from pole size to over-mature dominants. Different from the Jeffrey pine beetle, where successful attacks result in the death of the host tree, attack by the fir engraver can result in a) tree mortality, b) top-kill, or c) patch kill along the bole. Around Silver Lake, it can take 1 to 2 years to complete a generation. Adults fly and attack trees between June-September and as with the Jeffrey pine beetle, fading of the foliage often does not occur until the following spring. Fir engraver attacks are not characterized by pitch tubes on the bole; instead, the presence of boring dust in bark crevices and pitch streamers on the mid- and upper-bole are evidence of attack.

Pine engravers. Although not currently active in the areas evaluated, Ips spp. are present in the area and should be considered as they have the potential to affect management at Silver Lake. Pine engravers can breed in the tops of living pines or in fresh green slash. They have the potential in the Silver Lake area to go through 3 to 4 generations in one year. Attacks on live trees are generally limited to trees that are stressed by such factors as root disease, heavy dwarf mistletoe infection, drought,

fire or attack by other insects like the mountain pine beetle. Serious top-killing of green trees often occurs when fresh green slash is available in the spring, allowing populations to build-up and then to attack nearby standing trees during the summer. The top-killed pines may be more susceptible to subsequent attack by the mountain and Jeffrey pine beetles.

LIST OF PUBLICATIONS ENCLOSED
WITH ORIGINAL REPORT

Paine, L. A. 1971. Accident hazard evaluation and control decision on forested recreation sites. USDA For. Serv. Res. Pap. PSW-68 10p.

Paine, L. A. 1973. Administrative goals and safety standards for hazard control on forested recreation sites. USDA For. Serv. Res. Pap. PSW-88 13p.

Paine, L. A., and J. W. Clarke. 1978. Tree failures and accidents in recreation areas: a guide to data management for hazard control. USDA For. Serv. Gen. Tech. Rep. PSW-24. 30p.

Wagener, W. W. 1963. Judging hazard from native trees in California recreational areas: a guide for professional foresters. USDA For. Serv. Res. Pap. PSW-P1. 29p.

Smith, R. S., Jr. (unpubl.). Hazard Control. USDA For. Serv. R5, FPM Training Manual Supplement. 14p.